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The Developmental Significance of Dune Morphology in the Prairie Provinces of Canada

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A recent inventory of sand dune occurrences across the Canadian Prairie Provinces identified 125 isolated dune fields; 6 in Manitoba, 43 in Saskatchewan, and 76 in Alberta, covering a total area of about 34,000 km^2. The orientation and morphology of these deposits are indicative of the changing geologic and climatic conditions across the provinces during the Holocene. For each occurrence, orientations and morphologies were interpreted and classified from air photographs ranging in scale from 1:20 000 to 1:80 000.

Classification results reveal four regions of similar development with 5 sub-sections determined by morphological differences. These regions reflect the spatial variations in sediment supply (amount and grain size of source material), sediment availability (through moisture and vegetation), and wind regime (direction, duration, and intensity). Within each region, temporal variations can be extrapolated using current knowledge of Holocene climatic change as well as the relative chronologies recorded in the dune morphology.

Temporal and spatial variations have been combined using sediment state theory, outlining the development of the aeolian landscape within each region. The sediment supply was generated during the early Holocene (12,000 to 8,000), and is of glaciofluvial, glaciolacustrine, or glacial deltaic origins. Estimations of wind regime (transport capacity) over time were based upon modern wind data, allowing for greater winds in the early Holocene as indicated by climatic models, as well as general morphological characteristics. Current levels of activity determined sediment availability, with historic variability based upon climatic inferences. Benchmarks of past activity indicated by dune morphology are currently being verified using existing radiocarbon and luninescence dates, reducing the uncertainties of these initial diagrams.